WIND AND SOLAR NOW GENERATE ONE-TENTH OF GLOBAL ELECTRICITY

Global half-year electricity analysis

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This report shows evidence that wind and solar have quickly increased to become a major source of electricity in most countries in the world, and are successfully reducing coal generation throughout the world. Ember's new half-year analysis aggregates national electricity generation for 48 countries making up 83% of global electricity production. It builds on Ember's annual Global Electricity Review, released in March 2020.

Key findings

- **Wind and solar generation rose 14% in the first half of this year (H1-2020) compared to H1-2019, generating almost a tenth (9.8%) of global electricity.** In the 48 countries analysed, wind and solar generation rose from 992 terawatt hours in 2019 to 1,129 terawatt hours in H1-2020. That meant wind and solar's share of global electricity has risen from 8.1% in 2019 to 9.8% in H1-2020; and their share more than doubled from 4.6% in 2015, when the Paris Climate Agreement was signed. Wind and solar generated almost as much CO2-free power as nuclear power plants, which generated 10.5% of global electricity in H1-2020 and whose share remained unchanged from 2019.
- **Many key countries now generate around a tenth of their electricity from wind and solar:** China (10%), the US (12%), India (10%), Japan (10%), Brazil (10%) and Turkey (13%). The EU and UK were substantially higher with 21% and 33% respectively; within the EU, Germany rose to 42%. Russia is the largest country so far to shun wind and solar, with just 0.2% of its electricity from wind and solar.
- **Global coal generation fell 8.3% in the first half of 2020, compared to H1-2019.** This breaks a new record, following on from a year-on-year fall of 3% in 2019, which at the time was the biggest fall since at least 1990. The fall in H1-2020 is because electricity demand fell globally by 3.0% in H1-2020 due to COVID-19, as well as due to rising wind and solar. Although 70% of coal's fall in H1-2020 can be attributed to lower electricity demand due to COVID-19, 30% can be attributed to increased wind and solar generation. The US and the EU are racing to reduce coal, with falls of 31% and 32% respectively. China's coal fell only 2%, meaning its share of global coal generation rose to 54% so far this year, up from 50% in 2019 and 44% in 2015.

- **Wind and solar have captured a five percentage points market share from coal since 2015.** Coal's share fell from 37.9% in 2015 to 33.0% in the first half of 2020, as wind and solar grew from 4.6% to 9.8%. India's change was even more dramatic: wind and solar's share rose from 3% of total generation in 2015 to 10% in the first half of 2020; at the same time, coal's share fell from 77% to 68%. For the first time, the world's coal fleet ran at less than half of its capacity this year.
- **The global electricity transition is off-track for 1.5 degrees.** Coal needs to fall by 13% every year this decade, and even in the face of a global pandemic coal generation has only reduced 8% in the first half of 2020. The IPCC's 1.5 degree scenarios show coal needs to fall to just 6% of global generation by 2030, from 33% in H1-2020. The IPCC shows in all scenarios most of coal's replacement is with wind and solar.

> *"Countries across the world are now on the same path - building wind turbines and solar panels to replace electricity from coal and gas-fired power plants. But to keep a chance of limiting climate change to 1.5 degrees, coal generation needs to fall by 13% every year this decade. The fact that, during a global pandemic, coal generation has still only fallen by 8% shows just how far off-track we still are. We have the solution, it's working, it's just not happening fast enough."*

Dave Jones
Senior Electricity Analyst at Ember

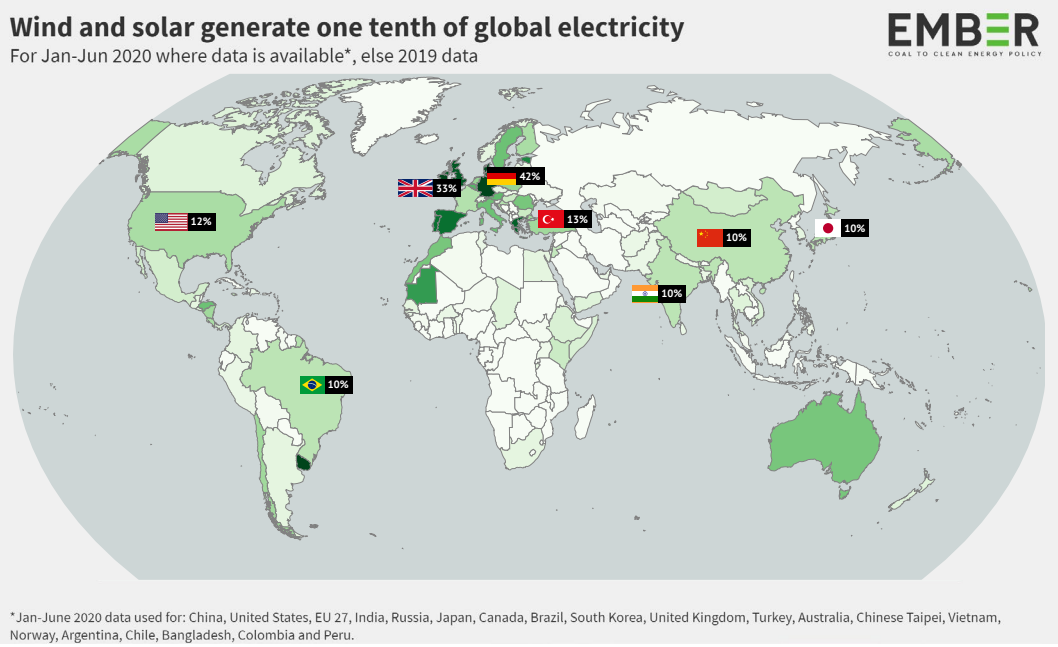
1. The rise of wind and solar

Wind and solar generation rose 14% in the first half of 2020 (H1-2020), compared to the first half of 2019. In the 48 countries analysed, wind and solar generation rose from 992 terawatt hours to 1,129 terawatt hours. Solar generation rose by 19% and wind generation rose by 11%. Although solar generation is catching up with wind generation, wind generation was still twice the level of solar generation in the countries analysed.

Wind and solar generated almost a tenth (9.8%) of global electricity in H1-2020. Global wind and solar generation was at 9.8% in the first half of 2020, up from 8.1% in 2019. This was calculated globally by scaling up 2019 for every country in the world by the 14% growth rate observed in the 48 countries analysed in this report. That means wind and solar generated almost as much CO2-free power as nuclear power plants, which generated 10.5% of global electricity in H1-2020.

Major countries across the world all had a similar level of wind and solar generation, in line with the global average: China 9.8%, the US 12.0%, India 9.7%, Japan 9.6%, Brazil 10.4% and Turkey 12.6%. The European Union was substantially higher, with 21.4%, the UK was at 33.2%, and Australia was also above-average. Within the EU, Germany rose to 42%. Russia (0.2%) is the largest country to so far shun wind and solar. Canada and South Korea stood out as having low levels of wind and solar share, at 5.3% and 4.0% respectively in H1-2020.

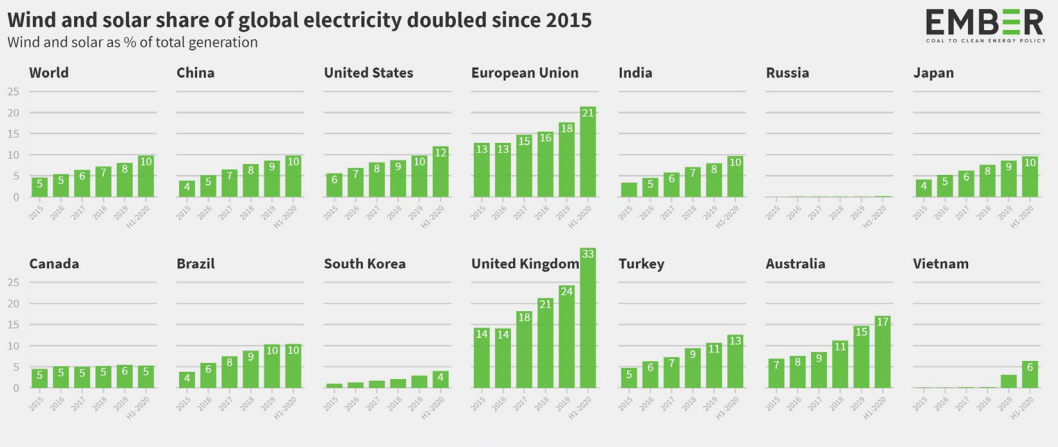
FIGURE 1



Wind and solar have doubled their share of global electricity generation since the Paris Climate Agreement was signed in 2015. They rose five percentage points, from 4.6% to 9.8%. Most large countries more than doubled their market share from 2015 to H1-2020: coincidentally China, Japan and Brazil all increased from 4% to 10%; the US from 6% to 12%. India's almost trebled from 3.4% in 2015 to 9.7% in H1-2020.

But other countries are lagging behind the global average: Canada's share has barely changed since 2015. South Korea's share has been increasing, but at 4.0% is still less than half the global average, and Vietnam is making up for lost time increasing from 0.2% in 2018 to 6.4% in the first half of 2020.

FIGURE 2



2. Wind and solar continue to replace coal

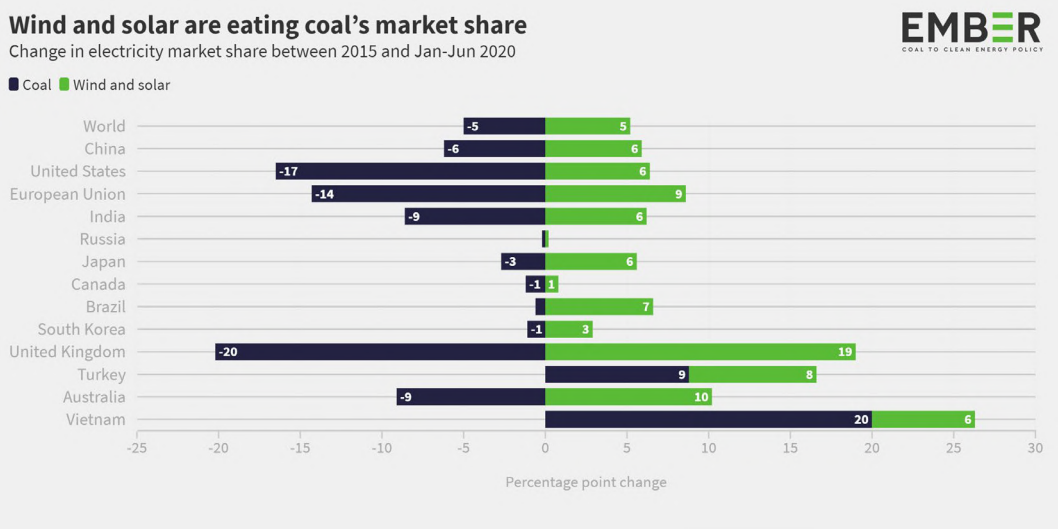
Wind and solar have captured five percentage points in market share from coal. Coal's share of global generation has fallen from 37.9% in 2015 to 33.0% in the first half of 2020. That fall of five percentage points has effectively been replaced by wind and solar, whose share rose from 4.6% to 9.8% in the first half of 2020.

That's a trend that happened across the world. For example, China's coal share has fallen by 7 percentage points as wind and solar increased by 6 percentage points.

Most remarkable is perhaps India, where wind and solar's market share has risen from 3% of its total generation in 2015 to 10% in the first half of 2020; at the same time, coal's share fell from 77% to 68%. Even in Vietnam, where coal has risen, wind and solar have risen six percentage points in just two years, thus reducing the pace of coal growth, and further weakening the case to build new coal power plants.

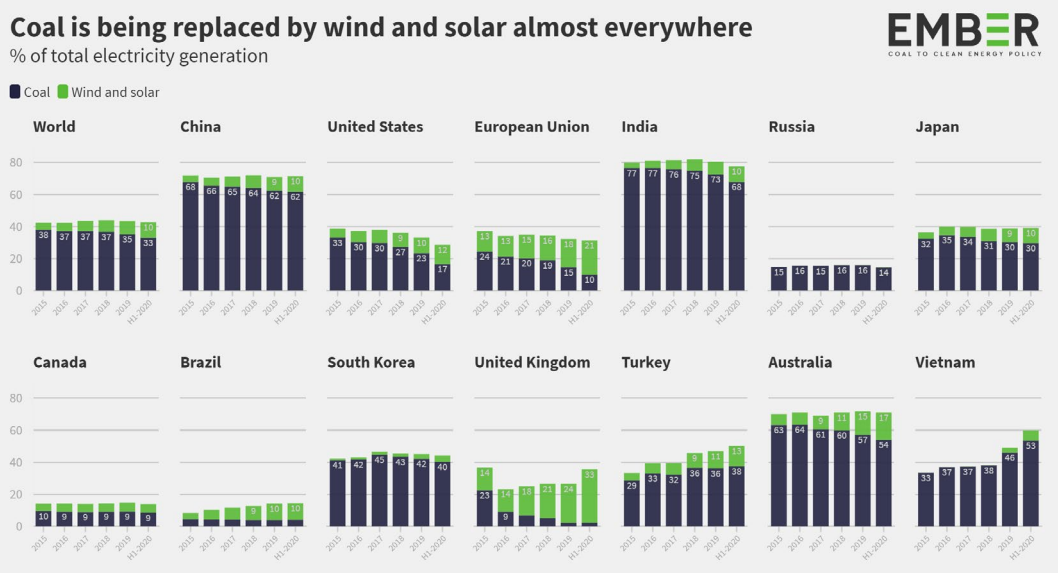
There are nuances, of course. In China, rapidly rising electricity demand means that although coal's share has fallen from 68% in 2015 to 62% in the first half of 2020, its absolute level of generation actually rose by 17% from 2015 to 2019. The US has replaced coal with gas more than with wind and solar: as coal's market share reduced by 17%, the share of gas increased 9% from 33% to 42% from 2015 to H1-2020, and wind and solar increased 6% from 6% to 12%.

FIGURE 3



So how far are countries into the transition? Well, much depends on where they started from. Most countries in Asia have a very large share of their electricity coming from coal, therefore, they have the most work to do.

FIGURE 4



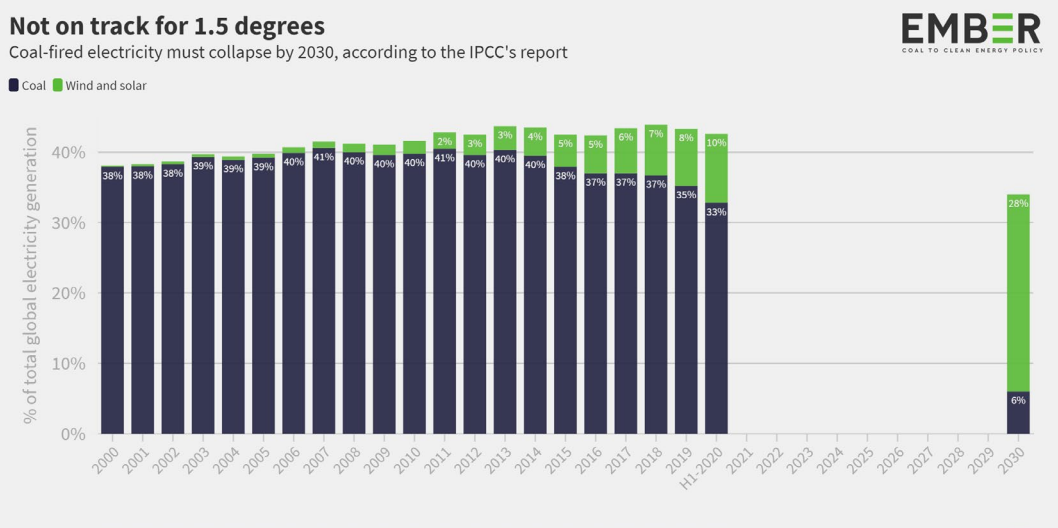
Unfortunately, this rapid change isn't enough to limit global temperature rises to 1.5 degrees. The IPCC published scenarios on how to limit global temperature rises to 1.5 degrees above pre-industrial levels. Carbon Brief's analysis of the IPCC scenarios shows unabated coal use needs to fall by about 79% by 2030 from 2019 - a fall of 13% every year throughout the 2020s.

Climate Analytics analysis is consistent, showing that coal needs to fall to just 6% share of global electricity generation; it was 33% in H1-2020. All 1.5-degree compatible IPCC scenarios show most of coal's fall needs to be replaced with wind and solar generation. The median of the scenarios show wind and solar reaching a 28% share by 2030.

It's clear that even with the rapid trajectory from coal to wind and solar over the last five years, progress is so far insufficient to limit coal generation in line with 1.5 degree scenarios.

IRENA data shows that the amount of wind and solar capacity installed in 2019 rose only 7%, and in 2018 rose only 5%. And the IEA estimates that renewable capacity growth in 2020 will fall by 13% due to the impact of COVID-19, compared to 2019. The year-on-year additions are helping to reshape the global electricity mix, but the rate of wind and solar deployed every year is not rapidly accelerating.

FIGURE 5



3. The COVID-19 impact and coal's fall

The drop in electricity demand due to COVID-19 barely impacted wind and solar generation in the first half of 2020. That's because wind and solar generation is lagged compared to when wind and solar are actually built; most of the rise in the first half of this year came from new wind and solar built last year. However, COVID-19 has impacted the rate of new wind and solar installed in 2020; a forecast by the IEA shows it will fall 13% in 2020 to its lowest level since 2015. Stimulus packages focusing on a clean transition can help that bounce back, but if stimulus is not forthcoming, wind and solar will struggle to achieve the levels of growth required this decade to limit warming to 1.5 degrees.

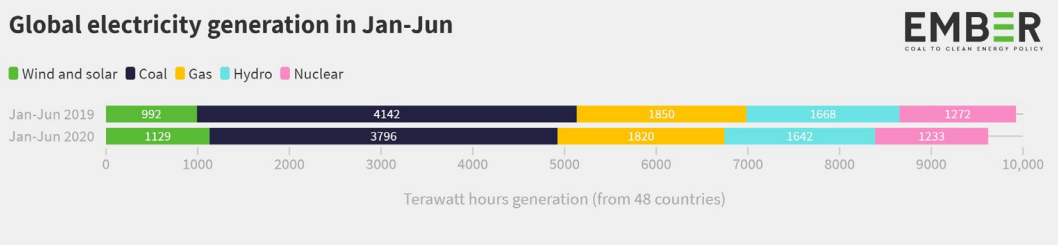
The disruption caused by COVID-19 severely impacted electricity demand, pushing down global electricity demand by around 3.0%. It was also particularly mild in the winter months of 2020 in many parts of the northern hemisphere, contributing to lower electricity demand. In H1-2020, demand was down in most countries - for example, 7% in the EU and 8% in India; the US fell only 4% as the COVID-19 impact was smaller, and China fell only about 1% due to large electricity demand growth in Q2-2020. The IEA has analysis on the falls by country throughout 2020 so far.

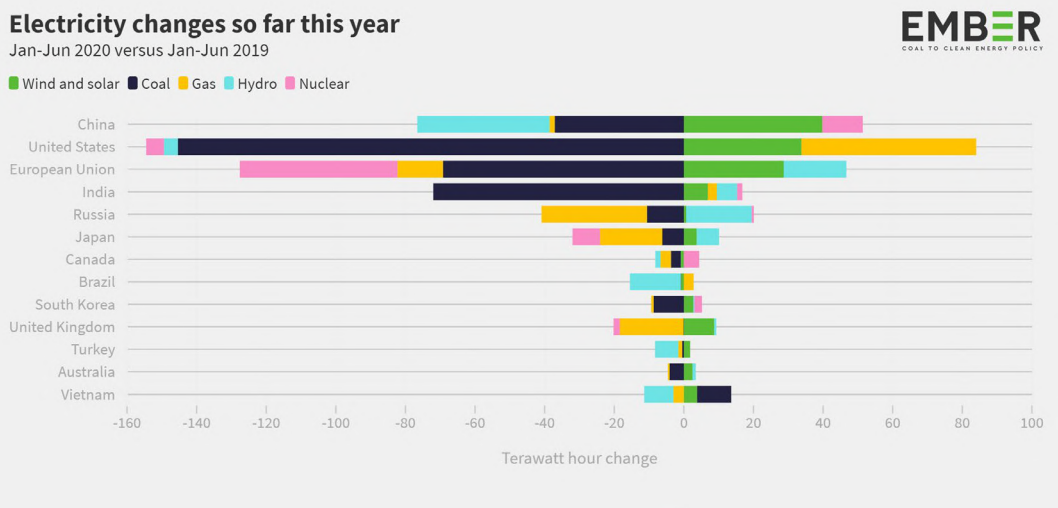
Coal generation fell by 8.3% (-346 TWh). 30% of coal's fall was due to increased wind and solar, and 70% was due to reduced electricity demand due to COVID-19. In the 48 countries examined, electricity demand fell by 311 TWh and wind and solar grew by 137 TWh, meaning conventional generation needed to fall by 448 TWh - that's a split of 70% due to lower electricity demand and 30% due to increased wind and solar power. Of that 448 TWh fall in conventional generation, 346 TWh was from lower coal generation, although all other forms were also down. Other factors contributing to the fall in coal include an increase in Chinese nuclear generation and a pick up in gas generation in the US.

Gas fell 1.6% (-30 TWh). Gas generation also fell slightly due to COVID-19 reducing electricity demand. Gas generation increased significantly in the US as gas replaced coal. This was offset by a large fall in Russia due to a very early snowmelt season due to record warm temperatures, and a large fall in European countries where coal generation was already near zero and thus gas generation took the brunt of the fall in demand (in the UK, Spain and Italy). However, this analysis misses key gas-generating countries like Iran, Saudi Arabia, Mexico and Egypt, because electricity data is not easily available, and therefore this global gas generation estimate has a higher error margin than the other fuel types.

Nuclear fell 3% (-39 TWh). COVID-19 severely impacted EDF's nuclear output in France, as operational plants needed to close, and plants on maintenance needed to stay offline for longer. This was partly offset by the continued uptick in Chinese nuclear output as they continued to build new reactors.

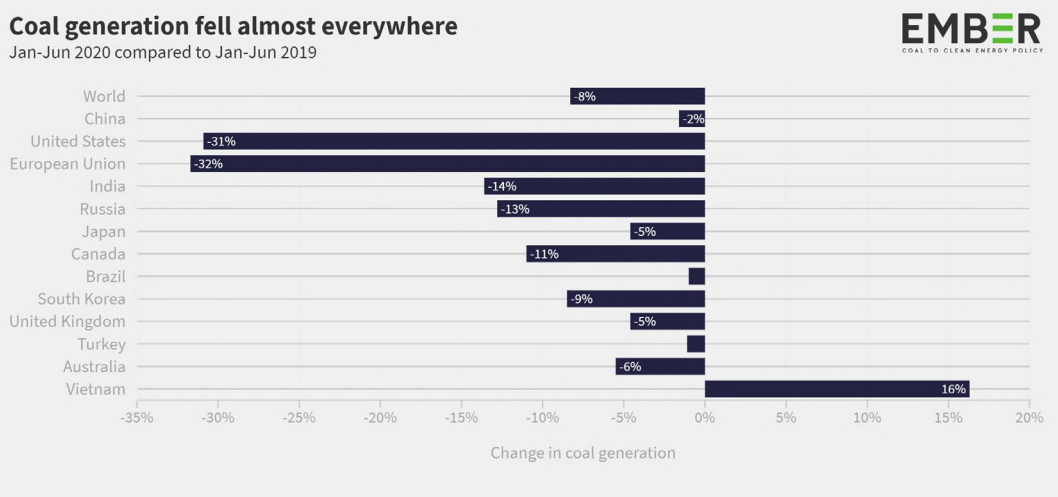
FIGURES 6 & 7





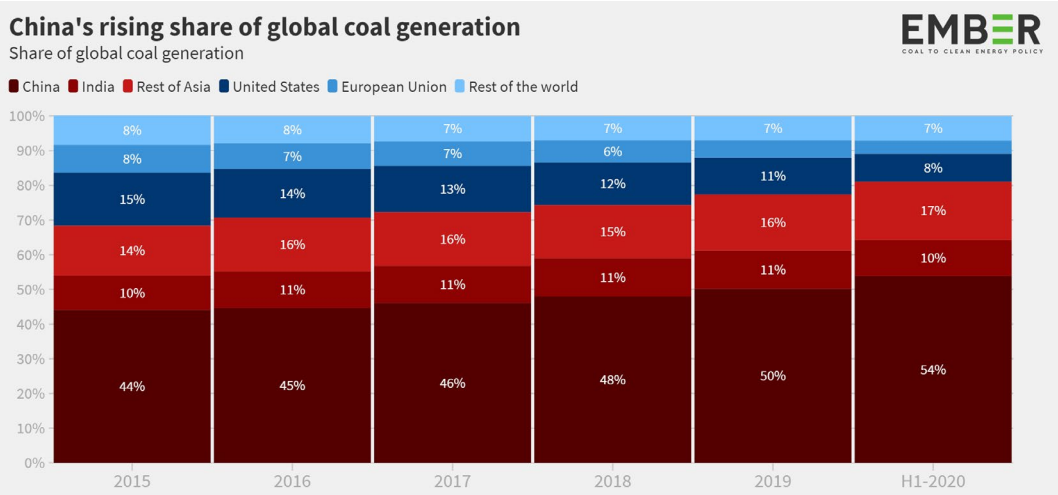
Coal generation fell by 8.3% in the first half of 2020. Two-thirds of this was due to the large falls in the US of 31% and the European Union of 32%. India's large fall of 14% happened even after a fall of 3% in 2019. China's fall was one of the smallest at just 2%, due to strong electricity demand growth in Q2-2020. Vietnam increased, but the increase in coal generation was similar to the fall in hydro generation.

FIGURE 8



As the US and Europe reduce their coal use, China's share of global coal generation continues to increase. The fall in coal generation in the US and EU means that their share of global coal generation has reduced from 23% in 2015 to 12% in H1-2020. Coal use in India and some other Asian countries is not increasing as some observers had expected. That means that China's share of global coal generation rose to 54% so far this year, up from 50% in 2019 and 44% in 2015.

FIGURE 9

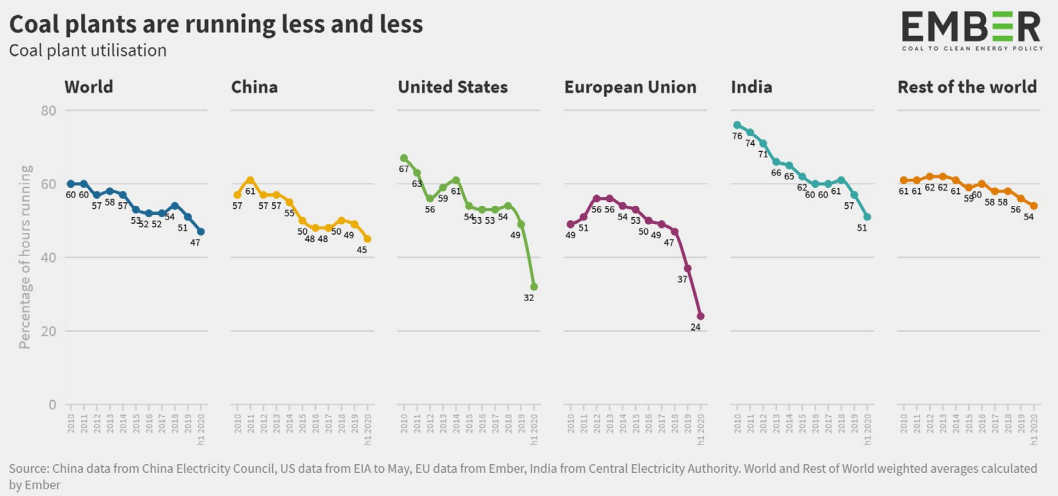


For the first time, coal plants were needed for less than half the time. Coal generation has fallen by 9%, but coal capacity fell only 0.1%. That means utilisation of coal plants has fallen to 47% in the first half of 2020, from 51% utilisation in 2019. That's the first time that coal plant utilisation has fallen below 50% over six months.

The fall in coal capacity in the first half of 2020 was the first time net global coal power plant capacity has fallen over six months. Global Energy Monitor (GEM) research showed that net coal capacity fell by 0.1% - by 2 gigawatts, against a total of 2047 gigawatts of operational coal plants. GEM showed that coal capacity rose in China, but fell in the rest of the world, meaning that China for the first time is home to over 50% of the world's coal capacity.

India coal plant utilisation fell as low as 42% in April and May, averaging 51% so far this year. With lower-than-expected demand for electricity, and wind and solar eating into coal's market share, there is an increasing surplus of coal capacity.

FIGURE 10



4. Country deep-dives

Let's analyse each key country in a little more detail.

China

Data from China Electricity Council showed wind and solar generation grew by 10% in H1-2020 compared to the same period last year, a slower rate than the global average of 14% in H1-2020, so China's share of wind and solar slipped from above-average to average. Wind and solar generation supplied 8.6% of China's electricity in 2019, above the global average of 8.1%, but in H1-2020 both China and the global average were 9.8%.

Wind and solar are replacing coal's share of the electricity mix - as the wind and solar share rose from 4% in 2015 to 10% in H1-2020, coal's share has fallen from 68% to 62% - a change of six percentage points each. However, because China's electricity demand has been rising so fast, even as coal's share of electricity generation is dropping fast, its coal generation is not. Even with COVID-19, China's Electricity Council predicted in July that electricity demand will return to rise 6% in the second half of this year. Hydro and nuclear generation are also growing, but they are struggling to even hold their market share against fast-increasing electricity demand.

China's share of global coal generation increased from 50% in 2019 to 54% in H1-2020. Thermal generation fell by 1.6% in the first half of 2020, compared to the same period last year, while the fall in coal generation was around 2%. Globally coal fell by 8% in H1-2020 compared to the same period last year, so a fall of just 2% means China is lagging as the world moves away from coal.

United States

The US seems to be in a race with the EU to ditch coal. Its coal generation fell 31% in H1-2020 (compared to H1-2019) as the EU fell 32%. In 2019, US coal generation fell 16% year-on-year, versus the EU falling 24%. The US increased its wind and solar generation by 16% in H1-2020 compared to the same period last year, slightly above the global average of 14%. But the US gas bridge continues to grow, with gas generation up 7% in H1-2020 despite COVID-19. Gas's share of US electricity generation has now risen from 33% in 2015 to 42% in H1-2020.

Europe (EU-27)

In July Ember published a European half year update, which showed renewables generation exceeded fossil generation for the first time, in the first half of this year. Wind and solar alone reached a record of 21% of Europe's total electricity generation, and reached even higher penetration in Denmark (64%), Ireland (49%) and Germany (42%). That - alongside the fall in electricity demand from COVID-19 - meant coal generation fell 32% year-on-year, and even gas generation fell 6% as well. Since 2015, coal's share has fallen from 24% to just 10%, whilst wind and solar's share has risen from 13% to 21%.

India

Wind and solar continue to grow in line with the global average, reducing India's reliance on coal. Wind and solar generation grew by 13% in H1-2020 compared to the same period last year (in comparison to 14% growth globally), and that meant wind and solar generated 9.7% of India's electricity (compared to 9.8% globally). Meanwhile, India's coal generation fell 14% in H1-2020 (compared to H1-2019). Coal's share of India's electricity has now fallen from 77% in 2015 to 68% in the first half of 2020, at the same time as wind and solar rose from 3.4% to 9.7%.

Russia

A large fall of 13% in thermal generation in H1-2020 (compared to H1-2019) was due to a one-off factor, rather than as part of the transition like in other countries. It was due to a 4% decrease in electricity demand and record hydro generation due to an early and aggressive snowmelt season. Wind and solar showed growth from a near-zero start, contributing 0.2% of Russia's total generation, one of the lowest rates in the world.

Japan

Wind and solar generation in Japan increased by only 9% in H1-2020 (compared to H1-2019), in comparison to the global average of 14% growth. That meant the proportion of Japan's electricity from wind and solar fell from above the global average in 2019, to below the global average in H1-2020. Wind and solar generation supplied 8.6% of Japan's electricity in 2019, above the global average of 8.1%, but in H1-2020 Japan increased to only 9.6% as the global average increased to 9.8%.

Canada

Canada's wind generation actually fell 5% in H1-2020 (compared to H1-2019), presumably due to lower wind speeds. The installed wind capacity in Canada has increased only from 11.2 gigawatts in 2015 to 13.4 gigawatts by the end of 2019. So whilst wind and solar power have almost doubled globally (from 4.6% of global generation in 2015 to 9.8% in H1-2020), Canada's share of electricity from wind and solar has barely budged, increasing from 4.5% in 2015 to 5.3% in H1-2020. Consequently neither coal nor gas have changed since 2015, still at 9% of the share each.

Brazil

Thermal generation rose by 38% in H1-2020 (compared to H1-2019) to fill the gap left by low hydro generation in 2020. Electricity demand fell by 5% in H1-2020 (compared to H1-2019), which moderated the rise in thermal generation. Brazil's wind and solar share is 10%, in line with the global average.

South Korea

The share of wind and solar was 3.6%, almost two-thirds lower than the global average. But wind and solar generation increased by 26% from H1-2019 to H1-2020, twice the average global growth rate, so it is slowly closing the gap albeit from a slow start. Coal generation fell 7%/7TWh, as electricity demand fell 2%/5TWh during H1-2020 compared to the same period last year.

United Kingdom

The UK saw its wind and solar share extend to one of the highest rates in the world, 33%. Also it's one of the few countries (alongside Spain and Italy), where wind and solar are significantly reducing gas generation, now that coal generation is already mostly phased out.

Turkey

Wind and solar generation increased by 12% from H1-2019 to H1-2020, increasing wind and solar generation to 12.6% of Turkey's electricity, against a global average of 9.8%. Lower electricity demand (-4%/-6TWh) almost completely offset the fall in hydro generation (-12%/-7TWh), leaving coal and gas generation mostly unchanged. This has reduced Turkey's need for new coal power plants.

Vietnam

Vietnam recorded probably the largest increase in solar generation of any country in H1-2020, rising 5.35 times compared to H1-2019. Vietnam is making up for lost time increasing its share of wind and solar from 0.2% of its electricity mix in 2018 to 6.4% in the first half of 2020. Coal generation rose, but this was mainly to cover a fall in hydro generation. Wind and solar are clearly weakening the case to build new coal power plants.

Methodology:

Ember collated monthly generation data for 2020 from 48 countries covering 83% of global electricity generation. This report includes data to end-June 2020, except for South Korea, Chinese Taipei and Japan, where assumptions are made for June which isn't yet published, and Canada for May and June. United States data for June 2020 has been estimated using hourly data for the lower-48 states. The biggest countries missing from this analysis are Saudi Arabia, Mexico, Iran, Indonesia, and South Africa, for which timely sources of monthly generation data do not exist. This global view scales up 2019 generation into H1-2020 for the changes observed in the 48 countries.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